PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	**IWASA, Shoji**
Application No.:	**10/674209**
Filed:	**September 29, 2003**
For:	**Polishing Composition and Rinse Composition**
Examiner:	**Michael A. Marcheschi**
Group Art Unit:	**1755**

Mail Stop _____
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Docket No.: O11.2B-11333-US01

SWORN SUPPLEMENTAL DECLARATION OF SHOJI IWASA

I, Shoji Iwasa state:

(1) I am the inventor of the above-identified U.S. patent application and I am currently employed by Fujimi Incorporated as an engineer in the research and development division. I have a bachelor's degree in synthetic chemistry. By virtue of this education and experience I have sufficient credentials and expertise to honestly and accurately present current skill in the art of polymer compositions and in particular water soluble compositions comprising hydroxyethyl cellulose (HEC) and/or polyethylene oxide (PEO).

(2) I am very familiar with the properties of water soluble polymers. I understand that the following claimed composition is excellent at reducing haze level of wafer surfaces:

HEC compounded in a quantity of between 0.01% and 3% by weight and having an average molecular weight of between 300,000 and 3,000,000;

PEO compounded in a quantity of between 0.005% and 0.5% by weight and having an average molecular weight of between 30,000 and 50,000,000;

an alkaline compound;

water; and

silicon dioxide.

(3) I have reviewed US Application 10/674209. The following additional information and tables illustrate that the inventive concept disclosed in the current claims display unexpected synergistic wafer surface haze reducing properties. Tables A and B were previously presented. Table A presents a few data points within the claimed ranges that display the unexpected synergistic results and Table B provides data points out of the claimed ranges that do not show the unexpected results. New Table C provides an extensive number of additional data points within the claimed ranges controlled for each individual range defining item. New Tables 1-12 are particular data sets listed in Table C which have been isolated to clearly illustrate the high point, low point, and mid values of each or the various ranges in the claims. The observed data shown in table C is so complete and representative that it can be used to extrapolate that every possible combination according to the claimed ranges will display the unexpected synergistic results. The data in table C when contrasted with that of table B also conclusively demonstrates that solutions outside of the claimed ranges will not show these same unexpected results.

(4) Table C – Unexpected results occur for the entire claimed range

Table C lists the haze reducing effects of the composition with the weight percentages and molecular weights of various proportions of HEC and PEO to demonstrate that for every possible permutation of the claimed ranges, unexpected synergistic results occur. Tables 1-12 break down this data into smaller units which control for each variable in the claimed ranges.

(5) Tables 1, 2, and 3 – Unexpected results occur when controlling for HEC molecular weight

Tables 1, 2, and 3 provide representative data demonstrating that for all compositions in which HEC has a molecular weight of between 300,000 and 3,000,000 as claimed in claim 1, unexpected results occur. Table 1 controls for HEC's ,molecular weight at the low end of the claimed range (300,000), table 2 at a value in the middle of the claimed range (1,200,000), and table 3 at a value representative of the high end of the claimed range (1,800,000). These three tables together show that shows that for all of the claimed values of HEC's molecular weight in base claim 1, where the HEC weight percentage varies from between 0.01% to 3% (with the

representative range of 0.05% to 2%) the composition will display unexpected results. Similarly it shows that for the claimed range of the molecular weight of HEC, in all circumstances where the PEO has a molecular weight of between 30,000 and 50,000,000 (with the representative sample of 80,000 to 8,000,000) the composition will display unexpected results. Lastly it also shows that for the claimed range of HEC's molecular weight, in all compositions where PEO has a weight percentage of 0.005% to 0.5%, unexpected results will occur.

(6) Tables 4, 5, and 6 – Unexpected results occur when controlling for HEC weight percentage

Tables 4, 5, and 6 provide representative data demonstrating that for all compositions in which HEC has a weight percentage of between 0.01% and 3% as claimed in claim 1, unexpected results occur. Table 4 controls for HEC's weight percentage at a value representative of the low end of the claimed range (0.05%), table 5 at a value in the middle of the claimed range (0.25%), and table 6 at a value representative of the high end of the claimed range (2%). These three tables together show that shows that for all of the claimed values of HEC's weight percentage in base claim 1, where the HEC's molecular weight varies from between 300,000 to 3,000,000 (with the representative range of 300,000 to 1,800,000) the composition will display unexpected results. Similarly it shows that for the claimed range of the weight percentage of HEC, in all circumstances where the PEO has a molecular weight of between 30,000 and 50,000,000 (with the representative sample of 80,000 to 8,000,000) the composition will display unexpected results. Lastly it also shows that for the claimed range of HEC's weight percentage, in all compositions where PEO has a weight percentage of 0.005% to 0.5%, unexpected results will occur.

(7) Tables 7, 8, and 9 – Unexpected results occur when controlling for PEO molecular weight

Tables 7, 8, and 9 provide representative data demonstrating for all solutions in which PEO has a molecular weight of between 30,000 and 50,000,000 as claimed in claim 1, unexpected results occur. Table 7 controls for PEO's molecular weight at a value representative of the low end of the claimed range (80,000), table 8 at a value in the middle of the claimed range (400,000), and table 9 at a value representative of the high end of the claimed range (8,000,000).

These three tables together show that shows that for all of the claimed values of PEO's molecular weight in claim 1, where the HEC weight percentage varies from between 0.01% to 3% (with the representative range of 0.05% to 2%) the composition will display unexpected results. Similarly it shows that for the claimed range of the molecular weight of PEO, in all circumstances where the HEC has a molecular weight of between 300,000 and 3,000,000 (with the representative sample of 300,000 to 1,800,000) the composition will display unexpected results. Lastly it also shows that for the claimed range of PEO's molecular weight, in all compositions where PEO has a weight percentage of 0.005% to 0.5%, unexpected results will occur.

(8) Tables 10, 11, and 12 – Unexpected results occur when controlling for PEO weight percentage

Tables 10, 11, and 12 provide representative data demonstrating that for all compositions in which PEO has a weight percentage of between 0.005% and 0.5% as claimed in claim 1, unexpected results occur. Table 10 controls for PEO's weight percentage the value at the low end of the claimed range (0.005%), table 11 at a value in the middle of the claimed range (0.1%), and table 12 at the value of the high end of the claimed range (0.5%). These three tables together show that shows that for all of the claimed values of PEO's weight percentage in claim 1, where the HEC's molecular weight varies from between 300,000 to 3,000,000 (with the representative range of 300,000 to 1,800,000) the composition will display unexpected results. Similarly it shows that for the claimed range of PEO's weight percentage, in all circumstances where the PEO has a molecular weight of between 30,000 and 50,000,000 (with the representative sample of 80,000 to 8,000,000) the composition will display unexpected results. Lastly it also shows that for the claimed range of PEO's weight percentage, in all compositions where PEO has a molecular weight of between 30,000 and 50,000,000 (with the representative range of 80,000 8,000,000), unexpected results will occur.

(9) **All claimed compositions having any alkaline compound at any weight percentage will show unexpected results.**

The same unexpected results that occur with ammonium at 1.0% also occur with *all* of the other alkaline compounds including: inorganic alkaline compounds such as potassium

hydroxide (PHA), sodium hydroxide (NHA), potassium hydrogen carbonate (PCAH), potassium carbonate (PCA), sodium hydrogen carbonate (NCAH), and sodium carbonate (NCA); ammonium salts such as ammonia (AN), tetramethyl ammonium hydroxide (TMAH), ammonium hydrogen carbonate (ACAH), and ammonium carbonate (ACA); and amines such as methylamine (MA), dimethylamine (DMA), trimethylamine (TMA), ethylamine (EA), diethylamine (DEA), triethylamine (TEA), ethylenediamine (EDA), monoethanolamine (MEA), N-(β-aminoethyl) ethanolamine (AEEA), hexamethylenediamine (HMDA), diethylenetriamine (DETA), triethylenetetramine (TETA), piperazine anhydride (PIZ), piperazine hexahydride, 1-(2-aminoethyl) piperazine (AEPIZ), and N-methylpiperazine (MPIZ), and any combination thereof. The unexpected haze reducing results can be obtained with claimed compositions having any kind of alkaline compound.

In addition, the unexpected results will occur with all weight percentages of such alkaline compounds and not only at a 1.0%. Deviations from within a preferred weight percent range between 0.01% to 6% will have a less pronounced unexpected haze reducing effect. Nevertheless, an unexpected haze reducing effect will occur for all possible weight percentages of alkaline compounds as stated in the claims.

(10) Conclusion

The claimed composition provides excellent haze level reduction of wafer surface without deteriorating LPD and surface conditions of the wafer surface. These reduction levels occur for all possible permutations within the claimed ranges. In particular, reductions occur for all claimed weight percentages of alkaline compounds and with all kinds of alkaline compounds. This advantage is not obvious over the teachings known to others of ordinary skill in this art.

(11) Oath

I declare that all statements made herein of my knowledge and are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine and imprisonment, both under 18 U.S.C. § 1001 and that such willful and false statements may jeopardize validity of the application or any patent issued thereon.

Date: August 23, 2006

Signature: Sayoji Iwasa

F:\wpwork\bec\11333US01_sts_20060717.doc

Table A

Supplemental Examples	Ingredient for reducing haze level						Ingredient for enhancing polishing rate		haze level	LPD	surface condition
	name	MW ($\times 10^4$)	wt%	name	MW ($\times 10^4$)	wt%	name	wt%			
1a	HEC	1200	0.01	PEO	150~400	0.1	AM	1.0	◎	△	-
1	HEC	1200	0.1	PEO	150~400	0.1	AM	1.0	◎	△	-
2a	HEC	1200	0.25	PEO	150~400	0.005	AM	1.0	◎	△	○
2	HEC	1200	0.25	PEO	150~400	0.01	AM	1.0	◎	△	○
3	HEC	1200	0.25	PEO	150~400	0.1	AM	1.0	☆	△	◎
5	HEC	1200	0.25	PEO	150~400	0.3	AM	1.0	◎	△	◎
5a	HEC	1200	0.25	PEO	150~400	0.5	AM	1.0	◎	△	-
6	HEC	1200	0.5	PEO	150~400	0.1	AM	1.0	◎	△	-
6a	HEC	1200	1	PEO	150~400	0.1	AM	1.0	◎	△	-

Table B

Supplemental Comparative Examples	Ingredient for reducing haze level						Ingredient for enhancing polishing rate		haze level	LPD	surface condition
	name	MW ($\times 10^4$)	wt%	name	MW ($\times 10^4$)	wt%	name	wt%			
Comp. Ex. 5a	HEC	1200	0.01	-			AM	1.0	△	×	-
Comp. Ex. 5b	HEC	1200	0.1	-			AM	1.0	○	△	-
Comp. Ex. 5	HEC	1200	0.25	-			AM	1.0	○	△	×
Comp. Ex. 5c	HEC	1200	0.5	-			AM	1.0	○	△	-
Comp. Ex. 5d	HEC	1200	1	-			AM	1.0	○	×	-
Comp. Ex. 9a	-			PEO	150~400	0.005	AM	1.0	×	×	-
Comp. Ex. 9b	-			PEO	150~400	0.01	AM	1.0	△	×	-
Comp. Ex. 9	-			PEO	150~400	0.1	AM	1.0	○	×	-
Comp. Ex. 9c	-			PEO	150~400	0.3	AM	1.0	△	×	-
Comp. Ex. 9d	-			PEO	150~400	0.5	AM	1.0	×	×	-

HEC: hydroxyethyl cellulose
PEO: polyethylene oxide
AM: 29wt% ammonium solution
As for evaluation of the polishing results, see the specification.
Examples 1–3, 5, 6, and Comparative Examples 5, 9 were described on the originally filed specification.
Examples 1a, 2a, 5a, 6a, and Comparative Examples 5a–5d, 9a–9a are newly presented.

TABLE C

All data

Example#	HEC MW ($x10^3$)	HEC wt%	PEO MW ($x10^3$)	PEO wt%	Alkaline	Alkaline wt%	Haze Level	LPD	Surface Condition
1					AM	1.0	◎	△	○
2	1,200				AM	1.0	◎	△	–
3					AM	1.0	◎	△	○
4		0.25			AM	1.0	◎	△	–
5	1,200	0.25			AM	1.0	◎	△	◎
6		0.25			AM	1.0	◎	△	–
7					AM	1.0	◎	△	–
8	1,200				AM	1.0	◎	△	–
9					AM	1.0	◎	△	○
10			150~400		AM	1.0	◎	△	–
11	1,200		150~400		AM	1.0	◎	△	–
12			150~400		AM	1.0	◎	△	–
13		0.25	150~400		AM	1.0	◎	△	–
14	1,200	0.25	150~400		AM	1.0	◎	△	○
15		0.25	150~400		AM	1.0	◎	△	–
16			150~400		AM	1.0	◎	△	○
17	1,200		150~400		AM	1.0	◎	△	–
18			150~400		AM	1.0	◎	△	–
19					AM	1.0	◎	△	○
20	1,200				AM	1.0	◎	△	–
21					AM	1.0	◎	△	–
22		0.25			AM	1.0	◎	△	–
23	1,200	0.25			AM	1.0	◎	△	◎
24		0.25			AM	1.0	◎	△	–
25					AM	1.0	◎	△	–
26	1,200				AM	1.0	◎	△	–
27					AM	1.0	◎	△	○
28				0.1	AM	1.0	◎	△	–
29	1,200			0.1	AM	1.0	◎	△	–
30				0.1	AM	1.0	◎	△	–
31		0.25		0.1	AM	1.0	☆	△	◎
32	1,200	0.25		0.1	AM	1.0	☆	△	–
33		0.25		0.1	AM	1.0	☆	△	–
34				0.1	AM	1.0	◎	△	–
35	1,200			0.1	AM	1.0	◎	△	–
36				0.1	AM	1.0	◎	△	–
37			150~400	0.1	AM	1.0	◎	△	◎
38	1,200		150~400	0.1	AM	1.0	◎	△	–
39			150~400	0.1	AM	1.0	◎	△	–
40		0.25	150~400	0.1	AM	1.0	☆	△	–
41	1,200	0.25	150~400	0.1	AM	1.0	☆	△	◎
42		0.25	150~400	0.1	AM	1.0	☆	△	–
43			150~400	0.1	AM	1.0	◎	△	–
44	1,200		150~400	0.1	AM	1.0	◎	△	–
45			150~400	0.1	AM	1.0	◎	△	◎
46				0.1	AM	1.0	◎	△	–
47	1,200			0.1	AM	1.0	◎	△	◎
48				0.1	AM	1.0	◎	△	–
49		0.25		0.1	AM	1.0	☆	△	–
50	1,200	0.25		0.1	AM	1.0	☆	△	◎
51		0.25		0.1	AM	1.0	☆	△	–
52				0.1	AM	1.0	◎	△	–
53	1,200			0.1	AM	1.0	◎	△	◎
54				0.1	AM	1.0	◎	△	–
55					AM	1.0	◎	△	–
56	1,200				AM	1.0	◎	△	–
57					AM	1.0	◎	△	○
58		0.25			AM	1.0	◎	△	○
59	1,200	0.25			AM	1.0	◎	△	–
60		0.25			AM	1.0	◎	△	–
61					AM	1.0	◎	△	–
62	1,200				AM	1.0	◎	△	○
63					AM	1.0	◎	△	–
64			150~400		AM	1.0	◎	△	–
65	1,200		150~400		AM	1.0	◎	△	◎
66			150~400		AM	1.0	◎	△	–
67		0.25	150~400		AM	1.0	◎	△	–
68	1,200	0.25	150~400		AM	1.0	◎	△	◎
69		0.25	150~400		AM	1.0	◎	△	–
70			150~400		AM	1.0	◎	△	–
71	1,200		150~400		AM	1.0	◎	△	–
72			150~400		AM	1.0	◎	△	○
73					AM	1.0	◎	△	–
74	1,200				AM	1.0	◎	△	–
75					AM	1.0	◎	△	○
76		0.25			AM	1.0	◎	△	–
77	1,200	0.25			AM	1.0	◎	△	–
78		0.25			AM	1.0	◎	△	–
79					AM	1.0	◎	△	–
80	1,200				AM	1.0	◎	△	–
81					AM	1.0	◎	△	○

Table 1 (HEC MW is fixed at a low end value)

Example#	HEC MW ($x10^3$)	HEC wt%	PEO MW ($x10^3$)	PEO wt%	Alkaline	Alkaline wt%	Haze Level	LPD	Surface Condition
1	300	0.05	150~400	0.1	AM	1.0	◎	△	○
4	300	0.25	150~400	0.1	AM	1.0	◎	△	–
7	300	2	150~400	0.1	AM	1.0	◎	△	–
10	300	0.05	150~400	0.5	AM	1.0	◎	△	–
13	300	0.25	150~400	0.5	AM	1.0	◎	△	–
16	300	2	150~400	0.5	AM	1.0	◎	△	○
19	300	0.05	6000~8000	0.1	AM	1.0	◎	△	○
22	300	0.25	6000~8000	0.1	AM	1.0	◎	△	–
25	300	2	6000~8000	0.1	AM	1.0	◎	△	–
28	300	0.05	150~400	0.1	AM	1.0	◎	△	–
31	300	0.25	150~400	0.1	AM	1.0	☆	△	◎
34	300	2	150~400	0.1	AM	1.0	◎	△	–
37	300	0.05	150~400	0.1	AM	1.0	◎	△	◎
40	300	0.25	150~400	0.1	AM	1.0	☆	△	–
43	300	2	150~400	0.1	AM	1.0	◎	△	–
46	300	0.05	6000~8000	0.1	AM	1.0	◎	△	–
49	300	0.25	6000~8000	0.1	AM	1.0	☆	△	–
52	300	2	6000~8000	0.1	AM	1.0	◎	△	–
55	300	0.05	150~400	0.5	AM	1.0	◎	△	–
58	300	0.25	150~400	0.5	AM	1.0	◎	△	○
61	300	2	150~400	0.5	AM	1.0	◎	△	–
64	300	0.05	150~400	0.5	AM	1.0	◎	△	–
67	300	0.25	150~400	0.5	AM	1.0	◎	△	–
70	300	2	150~400	0.5	AM	1.0	◎	△	–
73	300	0.05	6000~8000	0.5	AM	1.0	◎	△	–
76	300	0.25	6000~8000	0.5	AM	1.0	◎	△	–
79	300	2	6000~8000	0.5	AM	1.0	◎	△	–

Table 2 (HEC MW is fixed at a mid range value)

Example#	HEC MW ($x10^3$)	HEC wt%	PEO MW ($x10^3$)	PEO wt%	Alkaline	Alkaline wt%	Haze Level	LPD	Surface Condition
2	1,200	[illegible]	[illegible]	[illegible]	AM	1.0	◎	△	—
5	1,200	0.25	[illegible]	[illegible]	AM	1.0	◎	△	◎
8	1,200	[illegible]	[illegible]	[illegible]	AM	1.0	◎	△	—
11	1,200	[illegible]	150~400	[illegible]	AM	1.0	◎	△	—
14	1,200	0.25	150~400	[illegible]	AM	1.0	◎	△	○
17	1,200	[illegible]	150~400	[illegible]	AM	1.0	◎	△	—
20	1,200	[illegible]	[illegible]	[illegible]	AM	1.0	◎	△	—
23	1,200	0.25	[illegible]	[illegible]	AM	1.0	◎	△	◎
26	1,200	[illegible]	[illegible]	[illegible]	AM	1.0	◎	△	—
29	1,200	[illegible]	[illegible]	0.1	AM	1.0	◎	△	—
32	1,200	0.25	[illegible]	0.1	AM	1.0	☆	△	—
35	1,200	[illegible]	[illegible]	0.1	AM	1.0	◎	△	—
38	1,200	[illegible]	150~400	0.1	AM	1.0	◎	△	—
41	1,200	0.25	150~400	0.1	AM	1.0	☆	△	◎
44	1,200	[illegible]	150~400	0.1	AM	1.0	◎	△	—
47	1,200	[illegible]	[illegible]	0.1	AM	1.0	◎	△	◎
50	1,200	0.25	[illegible]	0.1	AM	1.0	☆	△	◎
53	1,200	[illegible]	[illegible]	0.1	AM	1.0	◎	△	◎
56	1,200	[illegible]	[illegible]	[illegible]	AM	1.0	◎	△	—
59	1,200	0.25	[illegible]	[illegible]	AM	1.0	◎	△	—
62	1,200	[illegible]	[illegible]	[illegible]	AM	1.0	◎	△	○
65	1,200	[illegible]	150~400	[illegible]	AM	1.0	◎	△	◎
68	1,200	0.25	150~400	[illegible]	AM	1.0	◎	△	◎
71	1,200	[illegible]	150~400	[illegible]	AM	1.0	◎	△	—
74	1,200	[illegible]	[illegible]	[illegible]	AM	1.0	◎	△	—
77	1,200	0.25	[illegible]	[illegible]	AM	1.0	◎	△	—
80	1,200	[illegible]	[illegible]	[illegible]	AM	1.0	◎	△	—

Table 3 (HEC MW is fixed at a high value)

Example#	HEC MW ($x10^3$)	HEC wt%	PEO MW ($x10^3$)	PEO wt%	Alkaline	Alkaline wt%	Haze Level	LPD	Surface Condition
3	1,800	0.05	80~120	0.1	AM	1.0	◎	△	○
6	1,800	0.25	80~120	0.1	AM	1.0	◎	△	–
9	1,800	2	80~120	0.1	AM	1.0	◎	△	○
12	1,800	0.05	150~400	0.1	AM	1.0	◎	△	–
15	1,800	0.25	150~400	0.1	AM	1.0	◎	△	–
18	1,800	2	150~400	0.1	AM	1.0	◎	△	–
21	1,800	0.05	6000~8000	0.1	AM	1.0	◎	△	–
24	1,800	0.25	6000~8000	0.1	AM	1.0	◎	△	–
27	1,800	2	6000~8000	0.1	AM	1.0	◎	△	○
30	1,800	0.05	80~120	0.1	AM	1.0	◎	△	–
33	1,800	0.25	80~120	0.1	AM	1.0	☆	△	–
36	1,800	2	80~120	0.1	AM	1.0	◎	△	–
39	1,800	0.05	150~400	0.1	AM	1.0	◎	△	–
42	1,800	0.25	150~400	0.1	AM	1.0	☆	△	–
45	1,800	2	150~400	0.1	AM	1.0	◎	△	◎
48	1,800	0.05	6000~8000	0.1	AM	1.0	◎	△	–
51	1,800	0.25	6000~8000	0.1	AM	1.0	☆	△	–
54	1,800	2	6000~8000	0.1	AM	1.0	◎	△	–
57	1,800	0.05	80~120	0.5	AM	1.0	◎	△	○
60	1,800	0.25	80~120	0.5	AM	1.0	◎	△	–
63	1,800	2	80~120	0.5	AM	1.0	◎	△	–
66	1,800	0.05	150~400	0.5	AM	1.0	◎	△	–
69	1,800	0.25	150~400	0.5	AM	1.0	◎	△	–
72	1,800	2	150~400	0.5	AM	1.0	◎	△	○
75	1,800	0.05	6000~8000	0.5	AM	1.0	◎	△	○
78	1,800	0.25	6000~8000	0.5	AM	1.0	◎	△	–
81	1,800	2	6000~8000	0.5	AM	1.0	◎	△	○

Table 4 (HEC wt% is fixed at a low value)

Example#	HEC MW ($x10^3$)	HEC wt%	PEO MW ($x10^3$)	PEO wt%	Alkaline	Alkaline wt%	Haze Level	LPD	Surface Condition
1	300	0.05	40~120	0.05	AM	1.0	◎	△	○
2	1,200	0.05	40~120	0.05	AM	1.0	◎	△	—
3	1,800	0.05	40~120	0.05	AM	1.0	◎	△	○
10	300	0.05	150~400	0.05	AM	1.0	◎	△	—
11	1,200	0.05	150~400	0.05	AM	1.0	◎	△	—
12	1,800	0.05	150~400	0.05	AM	1.0	◎	△	—
19	300	0.05	3000~8000	0.05	AM	1.0	◎	△	○
20	1,200	0.05	3000~8000	0.05	AM	1.0	◎	△	—
21	1,800	0.05	3000~8000	0.05	AM	1.0	◎	△	—
28	300	0.05	40~120	0.1	AM	1.0	◎	△	—
29	1,200	0.05	40~120	0.1	AM	1.0	◎	△	—
30	1,800	0.05	40~120	0.1	AM	1.0	◎	△	—
37	300	0.05	150~400	0.1	AM	1.0	◎	△	◎
38	1,200	0.05	150~400	0.1	AM	1.0	◎	△	—
39	1,800	0.05	150~400	0.1	AM	1.0	◎	△	—
46	300	0.05	3000~8000	0.1	AM	1.0	◎	△	—
47	1,200	0.05	3000~8000	0.1	AM	1.0	◎	△	◎
48	1,800	0.05	3000~8000	0.1	AM	1.0	◎	△	—
55	300	0.05	40~120	0.5	AM	1.0	◎	△	—
56	1,200	0.05	40~120	0.5	AM	1.0	◎	△	—
57	1,800	0.05	40~120	0.5	AM	1.0	◎	△	○
64	300	0.05	150~400	0.5	AM	1.0	◎	△	—
65	1,200	0.05	150~400	0.5	AM	1.0	◎	△	◎
66	1,800	0.05	150~400	0.5	AM	1.0	◎	△	—
73	300	0.05	3000~8000	0.5	AM	1.0	◎	△	—
74	1,200	0.05	3000~8000	0.5	AM	1.0	◎	△	—
75	1,800	0.05	3000~8000	0.5	AM	1.0	◎	△	○

Table 5 (HEC wt% is fixed at a mid range value)

Example#	HEC MW ($x10^3$)	HEC wt%	PEO MW ($x10^3$)	PEO wt%	Alkaline	Alkaline wt%	Haze Level	LPD	Surface Condition
4	[illegible]	0.25	[illegible]	[illegible]	AM	1.0	◎	△	—
5	1,200	0.25	[illegible]	[illegible]	AM	1.0	◎	△	◎
6	[illegible]	0.25	[illegible]	[illegible]	AM	1.0	◎	△	—
13	[illegible]	0.25	150~400	[illegible]	AM	1.0	◎	△	—
14	1,200	0.25	150~400	[illegible]	AM	1.0	◎	△	○
15	[illegible]	0.25	150~400	[illegible]	AM	1.0	◎	△	—
22	[illegible]	0.25	[illegible]	[illegible]	AM	1.0	◎	△	—
23	1,200	0.25	[illegible]	[illegible]	AM	1.0	◎	△	◎
24	[illegible]	0.25	[illegible]	[illegible]	AM	1.0	◎	△	—
31	[illegible]	0.25	[illegible]	0.1	AM	1.0	☆	△	◎
32	1,200	0.25	[illegible]	0.1	AM	1.0	☆	△	—
33	[illegible]	0.25	[illegible]	0.1	AM	1.0	☆	△	—
40	[illegible]	0.25	150~400	0.1	AM	1.0	☆	△	—
41	1,200	0.25	150~400	0.1	AM	1.0	☆	△	◎
42	[illegible]	0.25	150~400	0.1	AM	1.0	☆	△	—
49	[illegible]	0.25	[illegible]	0.1	AM	1.0	☆	△	—
50	1,200	0.25	[illegible]	0.1	AM	1.0	☆	△	◎
51	[illegible]	0.25	[illegible]	0.1	AM	1.0	☆	△	—
58	[illegible]	0.25	[illegible]	[illegible]	AM	1.0	◎	△	○
59	1,200	0.25	[illegible]	[illegible]	AM	1.0	◎	△	—
60	[illegible]	0.25	[illegible]	[illegible]	AM	1.0	◎	△	—
67	[illegible]	0.25	150~400	[illegible]	AM	1.0	◎	△	—
68	1,200	0.25	150~400	[illegible]	AM	1.0	◎	△	◎
69	[illegible]	0.25	150~400	[illegible]	AM	1.0	◎	△	—
76	[illegible]	0.25	[illegible]	[illegible]	AM	1.0	◎	△	—
77	1,200	0.25	[illegible]	[illegible]	AM	1.0	◎	△	—
78	[illegible]	0.25	[illegible]	[illegible]	AM	1.0	◎	△	—

Table 6 (HEC wt% is fixed at a high value)

Example#	HEC MW ($x10^3$)	HEC wt%	PEO MW ($x10^3$)	PEO wt%	Alkaline	Alkaline wt%	Haze Level	LPD	Surface Condition
7	300	2	50~120	0.1	AM	1.0	◎	△	—
8	1,200	2	50~120	0.1	AM	1.0	◎	△	—
9	1,800	2	50~120	0.1	AM	1.0	◎	△	○
16	300	2	150~400	0.1	AM	1.0	◎	△	○
17	1,200	2	150~400	0.1	AM	1.0	◎	△	—
18	1,800	2	150~400	0.1	AM	1.0	◎	△	—
25	300	2	6000~8000	0.1	AM	1.0	◎	△	—
26	1,200	2	6000~8000	0.1	AM	1.0	◎	△	—
27	1,800	2	6000~8000	0.1	AM	1.0	◎	△	○
34	300	2	50~120	0.1	AM	1.0	◎	△	—
35	1,200	2	50~120	0.1	AM	1.0	◎	△	—
36	1,800	2	50~120	0.1	AM	1.0	◎	△	—
43	300	2	150~400	0.1	AM	1.0	◎	△	—
44	1,200	2	150~400	0.1	AM	1.0	◎	△	—
45	1,800	2	150~400	0.1	AM	1.0	◎	△	◎
52	300	2	6000~8000	0.1	AM	1.0	◎	△	—
53	1,200	2	6000~8000	0.1	AM	1.0	◎	△	◎
54	1,800	2	6000~8000	0.1	AM	1.0	◎	△	—
61	300	2	50~120	0.5	AM	1.0	◎	△	—
62	1,200	2	50~120	0.5	AM	1.0	◎	△	○
63	1,800	2	50~120	0.5	AM	1.0	◎	△	—
70	300	2	150~400	0.5	AM	1.0	◎	△	—
71	1,200	2	150~400	0.5	AM	1.0	◎	△	—
72	1,800	2	150~400	0.5	AM	1.0	◎	△	○
79	300	2	6000~8000	0.5	AM	1.0	◎	△	—
80	1,200	2	6000~8000	0.5	AM	1.0	◎	△	—
81	1,800	2	6000~8000	0.5	AM	1.0	◎	△	○

Table 7 (PEO MW is fixed at a low value)

Example#	HEC MW ($x10^3$)	HEC wt%	PEO MW ($x10^3$)	PEO wt%	Alkaline	Alkaline wt%	Haze Level	LPD	Surface Condition
1					AM	1.0	◎	△	○
2	1,200				AM	1.0	◎	△	—
3					AM	1.0	◎	△	○
4		0.25			AM	1.0	◎	△	—
5	1,200	0.25			AM	1.0	◎	△	◎
6		0.25			AM	1.0	◎	△	—
7					AM	1.0	◎	△	—
8	1,200				AM	1.0	◎	△	—
9					AM	1.0	◎	△	○
28				0.1	AM	1.0	◎	△	—
29	1,200			0.1	AM	1.0	◎	△	—
30				0.1	AM	1.0	◎	△	—
31		0.25		0.1	AM	1.0	☆	△	◎
32	1,200	0.25		0.1	AM	1.0	☆	△	—
33		0.25		0.1	AM	1.0	☆	△	—
34				0.1	AM	1.0	◎	△	—
35	1,200			0.1	AM	1.0	◎	△	—
36				0.1	AM	1.0	◎	△	—
55					AM	1.0	◎	△	—
56	1,200				AM	1.0	◎	△	—
57					AM	1.0	◎	△	○
58		0.25			AM	1.0	◎	△	○
59	1,200	0.25			AM	1.0	◎	△	—
60		0.25			AM	1.0	◎	△	—
61					AM	1.0	◎	△	—
62	1,200				AM	1.0	◎	△	○
63					AM	1.0	◎	△	—

Table 8 (PEO MW is fixed at a mid range value)

Example#	HEC MW ($x10^3$)	HEC wt%	PEO MW ($x10^3$)	PEO wt%	Alkaline	Alkaline wt%	Haze Level	LPD	Surface Condition
10	300	0.05	150~400	0.005	AM	1.0	◎	△	–
11	1,200	0.05	150~400	0.005	AM	1.0	◎	△	–
12	1,800	0.05	150~400	0.005	AM	1.0	◎	△	–
13	300	0.25	150~400	0.005	AM	1.0	◎	△	–
14	1,200	0.25	150~400	0.005	AM	1.0	◎	△	○
15	1,800	0.25	150~400	0.005	AM	1.0	◎	△	–
16	300	2	150~400	0.005	AM	1.0	◎	△	○
17	1,200	2	150~400	0.005	AM	1.0	◎	△	–
18	1,800	2	150~400	0.005	AM	1.0	◎	△	–
37	300	0.05	150~400	0.1	AM	1.0	◎	△	◎
38	1,200	0.05	150~400	0.1	AM	1.0	◎	△	–
39	1,800	0.05	150~400	0.1	AM	1.0	◎	△	–
40	300	0.25	150~400	0.1	AM	1.0	☆	△	–
41	1,200	0.25	150~400	0.1	AM	1.0	☆	△	◎
42	1,800	0.25	150~400	0.1	AM	1.0	☆	△	–
43	300	2	150~400	0.1	AM	1.0	◎	△	–
44	1,200	2	150~400	0.1	AM	1.0	◎	△	–
45	1,800	2	150~400	0.1	AM	1.0	◎	△	◎
64	300	0.05	150~400	0.5	AM	1.0	◎	△	–
65	1,200	0.05	150~400	0.5	AM	1.0	◎	△	◎
66	1,800	0.05	150~400	0.5	AM	1.0	◎	△	–
67	300	0.25	150~400	0.5	AM	1.0	◎	△	–
68	1,200	0.25	150~400	0.5	AM	1.0	◎	△	◎
69	1,800	0.25	150~400	0.5	AM	1.0	◎	△	–
70	300	2	150~400	0.5	AM	1.0	◎	△	–
71	1,200	2	150~400	0.5	AM	1.0	◎	△	–
72	1,800	2	150~400	0.5	AM	1.0	◎	△	○

Table 9 (PEO MW is fixed at a high value)

Example#	HEC MW ($x10^3$)	HEC wt%	PEO MW ($x10^3$)	PEO wt%	Alkaline	Alkaline wt%	Haze Level	LPD	Surface Condition
19	[illegible]	[illegible]	[illegible]	[illegible]	AM	1.0	◎	△	○
20	1,200	[illegible]	[illegible]	[illegible]	AM	1.0	◎	△	—
21	[illegible]	[illegible]	[illegible]	[illegible]	AM	1.0	◎	△	—
22	[illegible]	0.25	[illegible]	[illegible]	AM	1.0	◎	△	—
23	1,200	0.25	[illegible]	[illegible]	AM	1.0	◎	△	◎
24	[illegible]	0.25	[illegible]	[illegible]	AM	1.0	◎	△	—
25	[illegible]	[illegible]	[illegible]	[illegible]	AM	1.0	◎	△	—
26	1,200	[illegible]	[illegible]	[illegible]	AM	1.0	◎	△	—
27	[illegible]	[illegible]	[illegible]	[illegible]	AM	1.0	◎	△	○
46	[illegible]	[illegible]	[illegible]	0.1	AM	1.0	◎	△	—
47	1,200	[illegible]	[illegible]	0.1	AM	1.0	◎	△	◎
48	[illegible]	[illegible]	[illegible]	0.1	AM	1.0	◎	△	—
49	[illegible]	0.25	[illegible]	0.1	AM	1.0	☆	△	—
50	1,200	0.25	[illegible]	0.1	AM	1.0	☆	△	◎
51	[illegible]	0.25	[illegible]	0.1	AM	1.0	☆	△	—
52	[illegible]	[illegible]	[illegible]	0.1	AM	1.0	◎	△	—
53	1,200	[illegible]	[illegible]	0.1	AM	1.0	◎	△	◎
54	[illegible]	[illegible]	[illegible]	0.1	AM	1.0	◎	△	—
73	[illegible]	[illegible]	[illegible]	[illegible]	AM	1.0	◎	△	—
74	1,200	[illegible]	[illegible]	[illegible]	AM	1.0	◎	△	—
75	[illegible]	[illegible]	[illegible]	[illegible]	AM	1.0	◎	△	○
76	[illegible]	0.25	[illegible]	[illegible]	AM	1.0	◎	△	—
77	1,200	0.25	[illegible]	[illegible]	AM	1.0	◎	△	—
78	[illegible]	0.25	[illegible]	[illegible]	AM	1.0	◎	△	—
79	[illegible]	[illegible]	[illegible]	[illegible]	AM	1.0	◎	△	—
80	1,200	[illegible]	[illegible]	[illegible]	AM	1.0	◎	△	—
81	[illegible]	[illegible]	[illegible]	[illegible]	AM	1.0	◎	△	○

Table 10 (PEO wt% is fixed at a low end value)

Example#	HEC MW ($x10^3$)	HEC wt%	PEO MW ($x10^3$)	PEO wt%	Alkaline	Alkaline wt%	Haze Level	LPD	Surface Condition
1	300	0.05	80~120	0.005	AM	1.0	◎	△	○
2	1,200	0.05	80~120	0.005	AM	1.0	◎	△	–
3	1,800	0.05	80~120	0.005	AM	1.0	◎	△	○
4	300	0.25	80~120	0.005	AM	1.0	◎	△	–
5	1,200	0.25	80~120	0.005	AM	1.0	◎	△	◎
6	1,800	0.25	80~120	0.005	AM	1.0	◎	△	–
7	300	2	80~120	0.005	AM	1.0	◎	△	–
8	1,200	2	80~120	0.005	AM	1.0	◎	△	–
9	1,800	2	80~120	0.005	AM	1.0	◎	△	○
10	300	0.05	150~400	0.005	AM	1.0	◎	△	–
11	1,200	0.05	150~400	0.005	AM	1.0	◎	△	–
12	1,800	0.05	150~400	0.005	AM	1.0	◎	△	–
13	300	0.25	150~400	0.005	AM	1.0	◎	△	–
14	1,200	0.25	150~400	0.005	AM	1.0	◎	△	○
15	1,800	0.25	150~400	0.005	AM	1.0	◎	△	–
16	300	2	150~400	0.005	AM	1.0	◎	△	○
17	1,200	2	150~400	0.005	AM	1.0	◎	△	–
18	1,800	2	150~400	0.005	AM	1.0	◎	△	–
19	300	0.05	6000~8000	0.005	AM	1.0	◎	△	○
20	1,200	0.05	6000~8000	0.005	AM	1.0	◎	△	–
21	1,800	0.05	6000~8000	0.005	AM	1.0	◎	△	–
22	300	0.25	6000~8000	0.005	AM	1.0	◎	△	–
23	1,200	0.25	6000~8000	0.005	AM	1.0	◎	△	◎
24	1,800	0.25	6000~8000	0.005	AM	1.0	◎	△	–
25	300	2	6000~8000	0.005	AM	1.0	◎	△	–
26	1,200	2	6000~8000	0.005	AM	1.0	◎	△	–
27	1,800	2	6000~8000	0.005	AM	1.0	◎	△	○

Table 11 (PEO wt% is fixed at a mid range value)

Example#	HEC MW ($x10^3$)	HEC wt%	PEO MW ($x10^3$)	PEO wt%	Alkaline	Alkaline wt%	Haze Level	LPD	Surface Condition
28	[illegible]	[illegible]	[illegible]	0.1	AM	1.0	◎	△	—
29	1,200	[illegible]	[illegible]	0.1	AM	1.0	◎	△	—
30	[illegible]	[illegible]	[illegible]	0.1	AM	1.0	◎	△	—
31	[illegible]	0.25	[illegible]	0.1	AM	1.0	☆	△	◎
32	1,200	0.25	[illegible]	0.1	AM	1.0	☆	△	—
33	[illegible]	0.25	[illegible]	0.1	AM	1.0	☆	△	—
34	[illegible]	[illegible]	[illegible]	0.1	AM	1.0	◎	△	—
35	1,200	[illegible]	[illegible]	0.1	AM	1.0	◎	△	—
36	[illegible]	[illegible]	[illegible]	0.1	AM	1.0	◎	△	—
37	[illegible]	[illegible]	150~400	0.1	AM	1.0	◎	△	◎
38	1,200	[illegible]	150~400	0.1	AM	1.0	◎	△	—
39	[illegible]	[illegible]	150~400	0.1	AM	1.0	◎	△	—
40	[illegible]	0.25	150~400	0.1	AM	1.0	☆	△	—
41	1,200	0.25	150~400	0.1	AM	1.0	☆	△	◎
42	[illegible]	0.25	150~400	0.1	AM	1.0	☆	△	—
43	[illegible]	[illegible]	150~400	0.1	AM	1.0	◎	△	—
44	1,200	[illegible]	150~400	0.1	AM	1.0	◎	△	—
45	[illegible]	[illegible]	150~400	0.1	AM	1.0	◎	△	◎
46	[illegible]	[illegible]	[illegible]	0.1	AM	1.0	◎	△	—
47	1,200	[illegible]	[illegible]	0.1	AM	1.0	◎	△	◎
48	[illegible]	[illegible]	[illegible]	0.1	AM	1.0	◎	△	—
49	[illegible]	0.25	[illegible]	0.1	AM	1.0	☆	△	—
50	1,200	0.25	[illegible]	0.1	AM	1.0	☆	△	◎
51	[illegible]	0.25	[illegible]	0.1	AM	1.0	☆	△	—
52	[illegible]	[illegible]	[illegible]	0.1	AM	1.0	◎	△	—
53	1,200	[illegible]	[illegible]	0.1	AM	1.0	◎	△	◎
54	[illegible]	[illegible]	[illegible]	0.1	AM	1.0	◎	△	—

Table 12 (PEO wt% is fixed at a high end value)

Example#	HEC MW ($x10^3$)	HEC wt%	PEO MW ($x10^3$)	PEO wt%	Alkaline	Alkaline wt%	Haze Level	LPD	Surface Condition
55	[illegible]	[illegible]	[illegible]	[illegible]	AM	1.0	◎	△	—
56	1,200	[illegible]	[illegible]	[illegible]	AM	1.0	◎	△	—
57	[illegible]	[illegible]	[illegible]	[illegible]	AM	1.0	◎	△	○
58	[illegible]	0.25	[illegible]	[illegible]	AM	1.0	◎	△	○
59	1,200	0.25	[illegible]	[illegible]	AM	1.0	◎	△	—
60	[illegible]	0.25	[illegible]	[illegible]	AM	1.0	◎	△	—
61	[illegible]	2	[illegible]	[illegible]	AM	1.0	◎	△	—
62	1,200	2	[illegible]	[illegible]	AM	1.0	◎	△	○
63	[illegible]	2	[illegible]	[illegible]	AM	1.0	◎	△	—
64	[illegible]	[illegible]	150~400	[illegible]	AM	1.0	◎	△	—
65	1,200	[illegible]	150~400	[illegible]	AM	1.0	◎	△	◎
66	[illegible]	[illegible]	150~400	[illegible]	AM	1.0	◎	△	—
67	[illegible]	0.25	150~400	[illegible]	AM	1.0	◎	△	—
68	1,200	0.25	150~400	[illegible]	AM	1.0	◎	△	◎
69	[illegible]	0.25	150~400	[illegible]	AM	1.0	◎	△	—
70	[illegible]	2	150~400	[illegible]	AM	1.0	◎	△	—
71	1,200	2	150~400	[illegible]	AM	1.0	◎	△	—
72	[illegible]	2	150~400	[illegible]	AM	1.0	◎	△	○
73	[illegible]	[illegible]	[illegible]	[illegible]	AM	1.0	◎	△	—
74	1,200	[illegible]	[illegible]	[illegible]	AM	1.0	◎	△	—
75	[illegible]	[illegible]	[illegible]	[illegible]	AM	1.0	◎	△	○
76	[illegible]	0.25	[illegible]	[illegible]	AM	1.0	◎	△	—
77	1,200	0.25	[illegible]	[illegible]	AM	1.0	◎	△	—
78	[illegible]	0.25	[illegible]	[illegible]	AM	1.0	◎	△	—
79	[illegible]	2	[illegible]	[illegible]	AM	1.0	◎	△	—
80	1,200	2	[illegible]	[illegible]	AM	1.0	◎	△	—
81	[illegible]	2	[illegible]	[illegible]	AM	1.0	◎	△	○